**South Dakota Agricultural Education (AFNR)**

**Academic Integration Activities**

**ACTIVITY #6**

*Ag Metal Fabrication students use knowledge of similarity in triangles to help in the design and construction of metal projects.*

1. **Ag Standard**

Ag Metal Fabrication Technology, AMF1.3: Create plans for project construction.

* Use scale measurement and dimension to develop plans and sketches for a shop project.

1. **Academic Standard**

9-12.G.1.2: Students are able to identify and apply relationships among triangles.

* Similarity Theorems

1. **Background Information**

Angle/side similarities in triangles can be useful knowledge in project construction especially when building two versions of the same plans – with one larger than the other.

The following three criteria are sufficient to prove that a pair of triangles is similar. The first two state that if triangles have the same shape (AA criterion) then they are similar, and that if they are to scale (SSS criterion) then they are similar. The third criterion, SAS, combines some of the information used by each of the first two.

AA: if two triangles have two corresponding pairs of angles with the same measure then they are similar. Sometimes this criterion is also referred to as AAA because equality across triangles of two angles implies equality of the third. This criterion means that if a triangle is copied to preserve the shape, then the copy is to scale.

SSS (Three sides proportional): If the ratio of corresponding sides of two triangles does not depend on the pair of corresponding sides chosen, then the triangles are similar. This means that any triangle copied to scale is also copied in shape.

SAS (Ratio of two sides, included angle): if two sides in a triangle are proportional to two corresponding sides in another triangle, and the angles included between these sides have the same measure in each triangle, then the triangles are similar. This means that to enlarge a triangle, it is sufficient to copy one angle, and scale just the two sides that form the angle.

1. **Example in Context**

Scenario:

You are building metal feed bunks or calves that you want to be about two-thirds the size of regular feed bunks to make it easier for calves to feed from. You are using a regular-sized feed bunk as your template. A brace in the bunk leg measures the following:

10”

6”

8”

You have cut out two triangles from sheet metal and are trying to remember which is supposed to be the one that is similar to the one in the regular sized bunk. Which is it?

#1

#2

5”

3”

4”

8”

4”

6”

Which similarity theorem did you use to make your choice – AA, SSS, SAS?

*Answer:*

*Triangle #1 is the similar triangle to that in the regular sized feed bunk. You could use either the SSS or SAS theorems. SSS works because the ratio (2:1 in this case) of all three sides is the same 10:5, 6:3, and 8:4. SAS work because there is a right angle in the triangles and you can use the ratio of the sides on each side of this right angle to determine similarity – 6:3 on one side of the right angle and 8:4 on the other (both are 2:1 ratios).*

1. **Guided Practice Exercise**

Scenario:

You are trying to build a bale feeder that is slightly larger than one you are using as a model. One of the pieces on the bale feeder is a triangle of sheet metal with the following dimensions:

5”

3”

7”

You have found three triangles of sheet metal in the cut metal pile that look kind of like your model triangle and are just a bit bigger. Using one of the similarity theorems, determine which of the triangles you’ve found is similar to the triangle from the model bale feeder,

3.5”

5.5”

7.5”

10.5”

4.5”

9”

7”

5”

7.5”

*Answer: The middle triangle is the only one similar to the original triangle. The SSS theorem is the only one that can be used in this situation as we don’t know any of the angles of the triangles, so we have to rely on finding the ratio of each of the corresponding sides.*

1. **Independent Practice Exercises**

Scenario:

You are reinforcing the frame of a stock trailer. A piece of sheet metal has been cut to reinforce one of the back corners. A similar triangle is needed for the front corner. You tell your project partner to cut a similar triangle, but 1.5 times as big as the original. The image on the left is the original. The image on the right is what your partner cut out. Is the new triangle similar to the original? How can you tell?

6”

5”

4”

7.5”

Original

New

*Answer: Yes. The new triangle is similar. You can tell because of the SAS theorem. You have a right angle and the sides on each side of that angle. The two sides are each 1.5 times as long (same ratio) as the original making this a similar triangle.*

1. **Notes**

If you use drawing software to have students create project plans, have them draw similar triangles using one of the three theorems.